L Number	Hits	Search Text	DB	Time stamp
3	0	forward$4 near10 request$1 near10 (check$4 near10 table$1) near10 (server$1 proxy proxies) and @ad<20000803 and 709/226.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 08:14
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14	4	(proxy proxies) near10 table$1 same default and @ad<20000803 and 709/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 08:56
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26	8	compar$4 near10 server$1 near5 IP near10 (proxy proxies) and @ad<20000803	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 09:16
27	0	compar$4 near10 resource$1 near5 IP near10 (proxy proxies) and @ad<20000803	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 09:17
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35	134	forward$4 near10 request$1 near10 (proxy proxies) near10 (address$3 URL$1 server$1 destination$1) and @ad<20000803 and 709/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 09:31
36	14	forward$4 near10 request$1 near10 (proxy proxies) near10 (address$3 URL$1 server$1 destination$1) and @ad<20000803 and 709/226.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 09:31
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-	2	select$4 near10 (proxy or proxies) near10 speed$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 13:05
-	170	select$4 near10 (server$1) near10 speed$1	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 13:06
-	101	select$4 near10 (server$1) near10 speed$1 and @ad<20000803	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 13:06
-	38	select$4 near10 (server$1) near10 speed$1 and @ad<20000803 and 709/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 14:06
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-	1	select$4 near10 (server$1) near10 speed$1 and @ad<20000803 and 709/226.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 14:07

-	2	select$4 near10 (server$1) near10 speed$1 and @ad<20000803 and 709/229.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 08:45
-	7	select$4 near10 (server$1 proxy proxies) near10 destination$1 and @ad<20000803 and 709/226.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 14:27
-	73	forward$4 near10 request$1 near10 (resource$1 page$1 webpage$1 website$1) near10 (server$1 proxy proxies) and @ad<20000803 and 709/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 08:33
-	98	select$4 near10 (server$1 proxy proxies) near10 destination$1 and @ad<20000803 and 709/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/25 14:29
-	11	forward$4 near10 request$1 near10 (resource$1 page$1 webpage$1 website$1) near10 (server$1 proxy proxies) and @ad<20000803 and 709/226.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/08/26 08:14

Your search matched **[0]** of **[962108]** documents.

You may refine your search by editing the current search expression or entering a new one the text box. Then click search Again.

compar* <near/10> server* <near/10> ip <near/10> pro Search Again

OR

Use your browser's back button to return to your original search page.

Results:

No documents matched your query.

US006185616B1

(12) **United States Patent**
Namma et al.

(10) **Patent No.: US 6,185,616 B1**
(45) **Date of Patent: Feb. 6, 2001**

(54) **PROXY SERVER APPARATUS, A PROXY SERVER SYSTEM, AND A SERVER APPARATUS**

(75) Inventors: **Eimei Namma**, Tokyo; **Tomomi Kaga**, Kawasaki, both of (JP)

(73) Assignee: **Matsushita Electric Industrial Co., Ltd.** (JP)

(*) Notice: Under 35 U.S.C. 154(b), the term of this patent shall be extended for 0 days.

(21) Appl. No.: **08/897,323**

(22) Filed: **Jul. 21, 1997**

(30) **Foreign Application Priority Data**

Aug. 23, 1996 (JP) 8-222123

(51) **Int. Cl.**[7] **G06F 15/16**
(52) **U.S. Cl.** **709/227**; 709/225
(58) **Field of Search** 709/227, 249, 709/219, 217, 218, 228, 225; 370/352; 713/201

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Primary Examiner—Kenneth R. Coulter
Assistant Examiner—Patrice L. Winder
(74) *Attorney, Agent, or Firm*—Parkhurst & Wendell, L.L.P.

(57) **ABSTRACT**

A proxy server apparatus (APP) coupled to a network and a TEL network is disclosed, which comprises: a receiving portion for receiving a request, from a client terminal coupled to the network, for connection to a desired server APP therethrough via the TEL network, the request including a name of the server; an address table for storing the name and corresponding TEL NO.; a PPP connection portion for dynamically assigning an IP address to the desired server APP from the name according to the address table and for providing PPP connection between the desired server APP and the proxy server APP; and a COMM providing portion for providing communication between the client terminal and the desired server APP using the IP address. A proxy server system including a plural proxy server APP is also disclosed, wherein a request is forwarded to a desired server according to a proxy server arrangement table in each proxy server APP and communication is routed through other server APP. The proxy server arrangement table is determined according to distance in TEL network or data rate of the proxy server APP. A server APP is disclosed which informs the proxy server coupled thereto of disconnection when all circuits to the proxy server are in non communication condition for a predetermined interval.

10 Claims, 8 Drawing Sheets

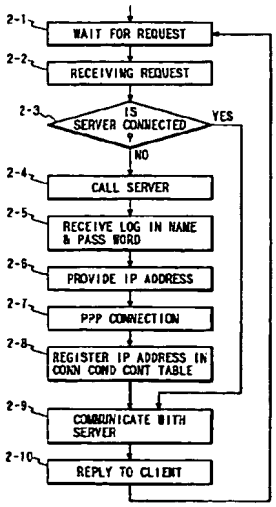

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FIG. 1

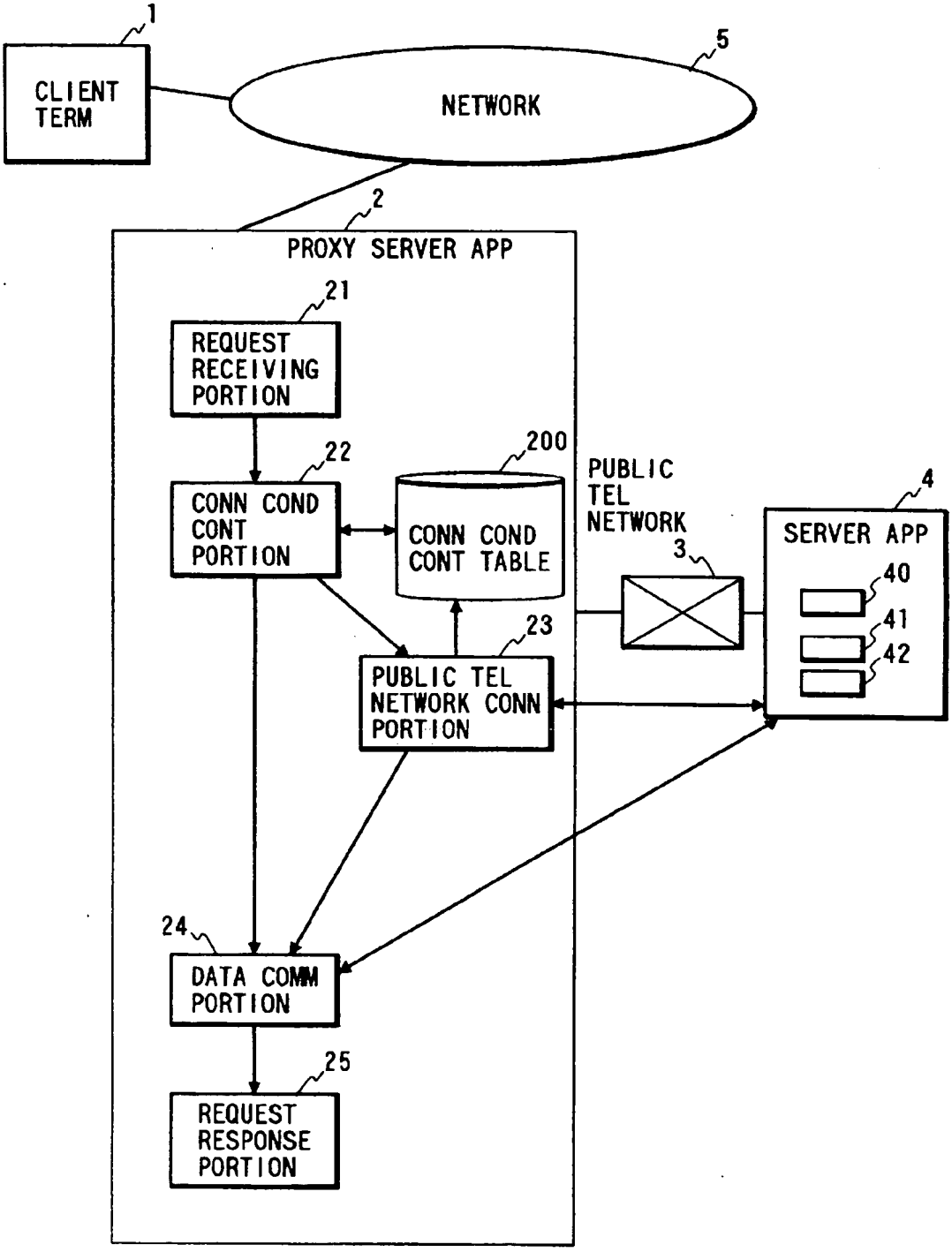
1
CLIENT TERM
5
NETWORK
2
PROXY SERVER APP
21
REQUEST RECEIVING PORTION
22
CONN COND CONT PORTION
200
CONN COND CONT TABLE
PUBLIC TEL NETWORK
3
4
SERVER APP
40
41
42
23
PUBLIC TEL NETWORK CONN PORTION
24
DATA COMM PORTION
25
REQUEST RESPONSE PORTION

FIG. 2

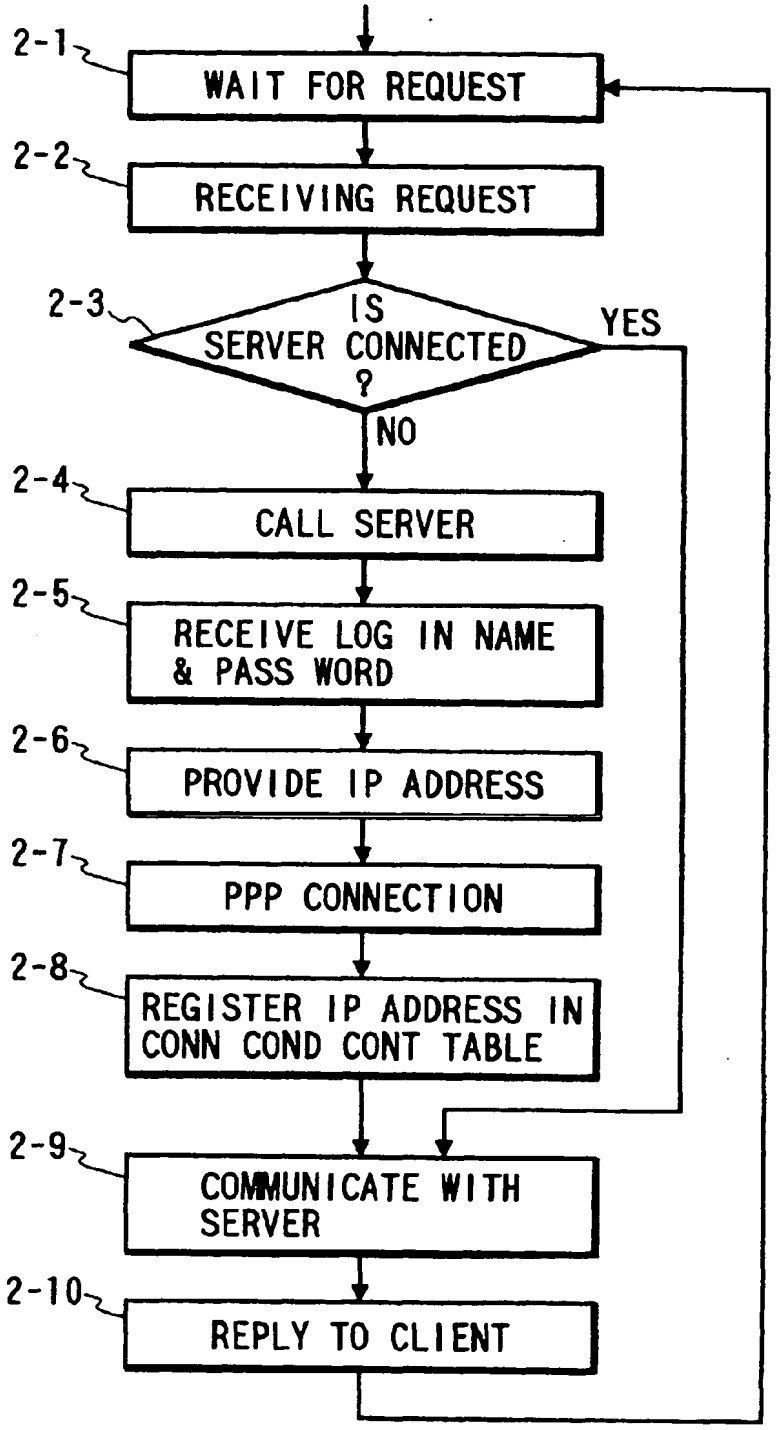
2-1
WAIT FOR REQUEST
2-2
RECEIVING REQUEST
2-3
IS SERVER CONNECTED ?
YES
NO
2-4
CALL SERVER
2-5
RECEIVE LOG IN NAME & PASS WORD
2-6
PROVIDE IP ADDRESS
2-7
PPP CONNECTION
2-8
REGISTER IP ADDRESS IN CONN COND CONT TABLE
2-9
COMMUNICATE WITH SERVER
2-10
REPLY TO CLIENT

FIG. 3

200

SERVER NAME	IP ADDRESS	TEL NO.
NANMA	133.185.001.001	03−1234−5678
KAGA	133.185.001.002	03−9012−3456
YAMADA		03−7890−1234

FIG. 4

42

CLIENT IP ADDRESS	COMM COND	NON-COMM TIME (MIN)
133.185.001.001	COMM	0
133.185.001.002	COMM	0
133.185.001.003	NON-COMM	30
133.185.001.004	NON-COMM	10

FIG. 5

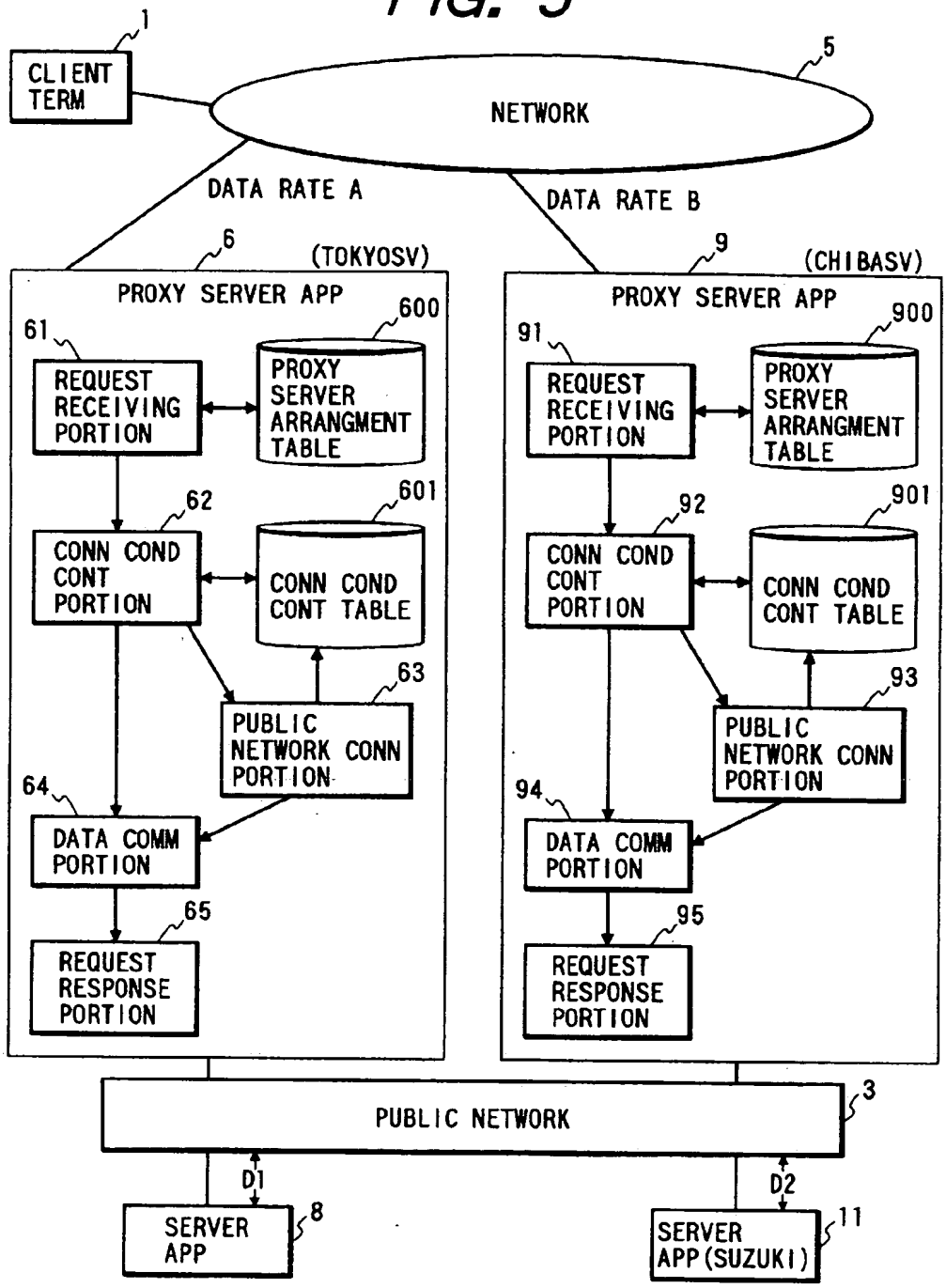
1
CLIENT TERM
5
NETWORK
DATA RATE A
DATA RATE B
6
(TOKYOSV)
PROXY SERVER APP
600
61
REQUEST RECEIVING PORTION
PROXY SERVER ARRANGMENT TABLE
62
601
CONN COND CONT PORTION
CONN COND CONT TABLE
63
PUBLIC NETWORK CONN PORTION
64
DATA COMM PORTION
65
REQUEST RESPONSE PORTION
9
(CHIBASV)
PROXY SERVER APP
900
91
REQUEST RECEIVING PORTION
PROXY SERVER ARRANGMENT TABLE
92
901
CONN COND CONT PORTION
CONN COND CONT TABLE
93
PUBLIC NETWORK CONN PORTION
94
DATA COMM PORTION
95
REQUEST RESPONSE PORTION
PUBLIC NETWORK
3
D1
D2
SERVER APP
8
SERVER APP(SUZUKI)
11

FIG. 6

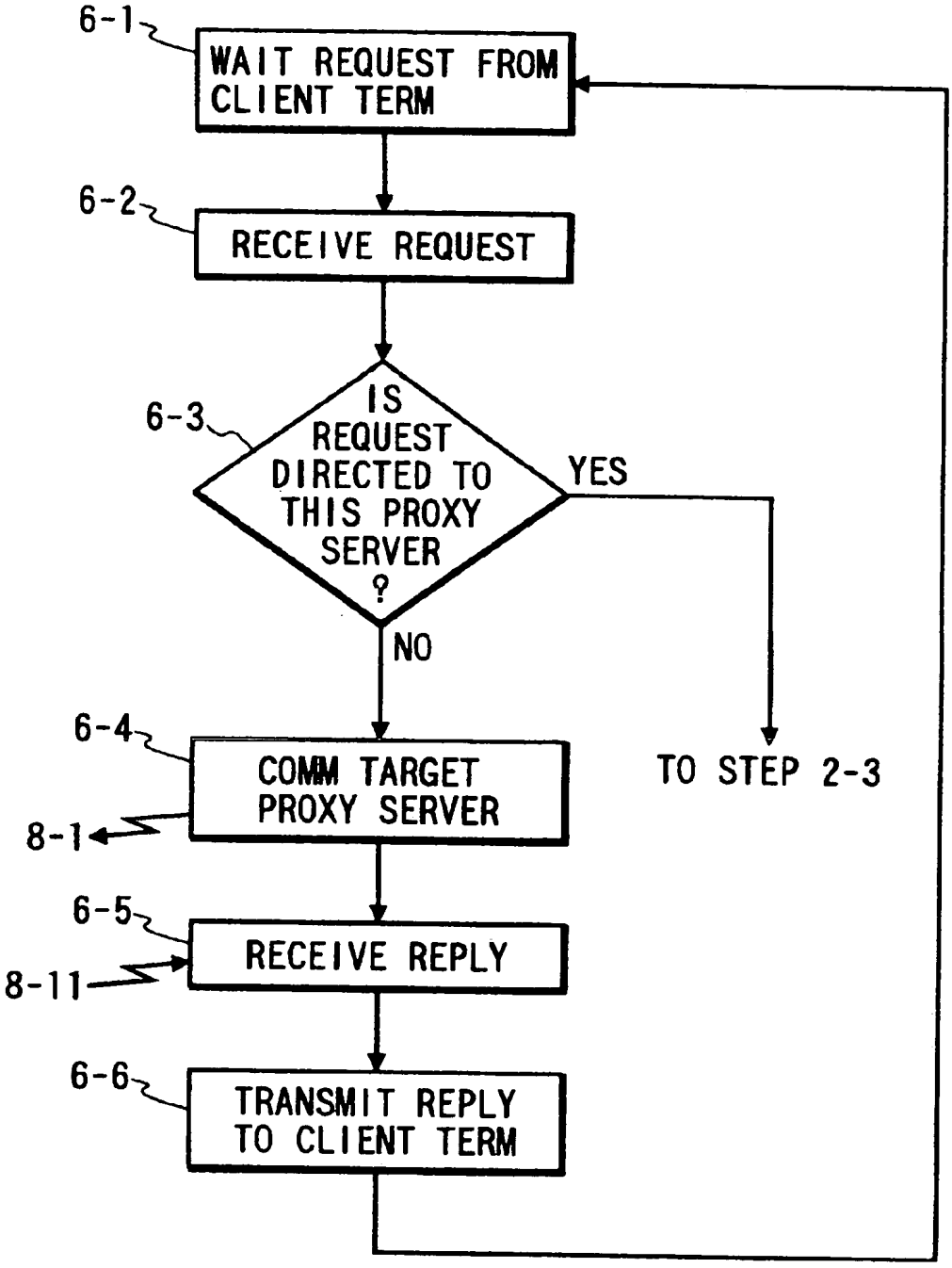
6-1
WAIT REQUEST FROM CLIENT TERM
6-2
RECEIVE REQUEST
6-3
IS REQUEST DIRECTED TO THIS PROXY SERVER ?
YES
NO
TO STEP 2-3
6-4
COMM TARGET PROXY SERVER
8-1
6-5
RECEIVE REPLY
8-11
6-6
TRANSMIT REPLY TO CLIENT TERM

FIG. 7

SERVER NAME	PROXY SERVER NAME
NANMA	TOKYOSV
KAGA	TOKYOSV
YAMADA	TOKYOSV
SATO	YOKOHAMASV
KATO	YOKOHAMASV
TANAKA	CHIBASV
SUZUKI	CHIBASV

FIG. 8

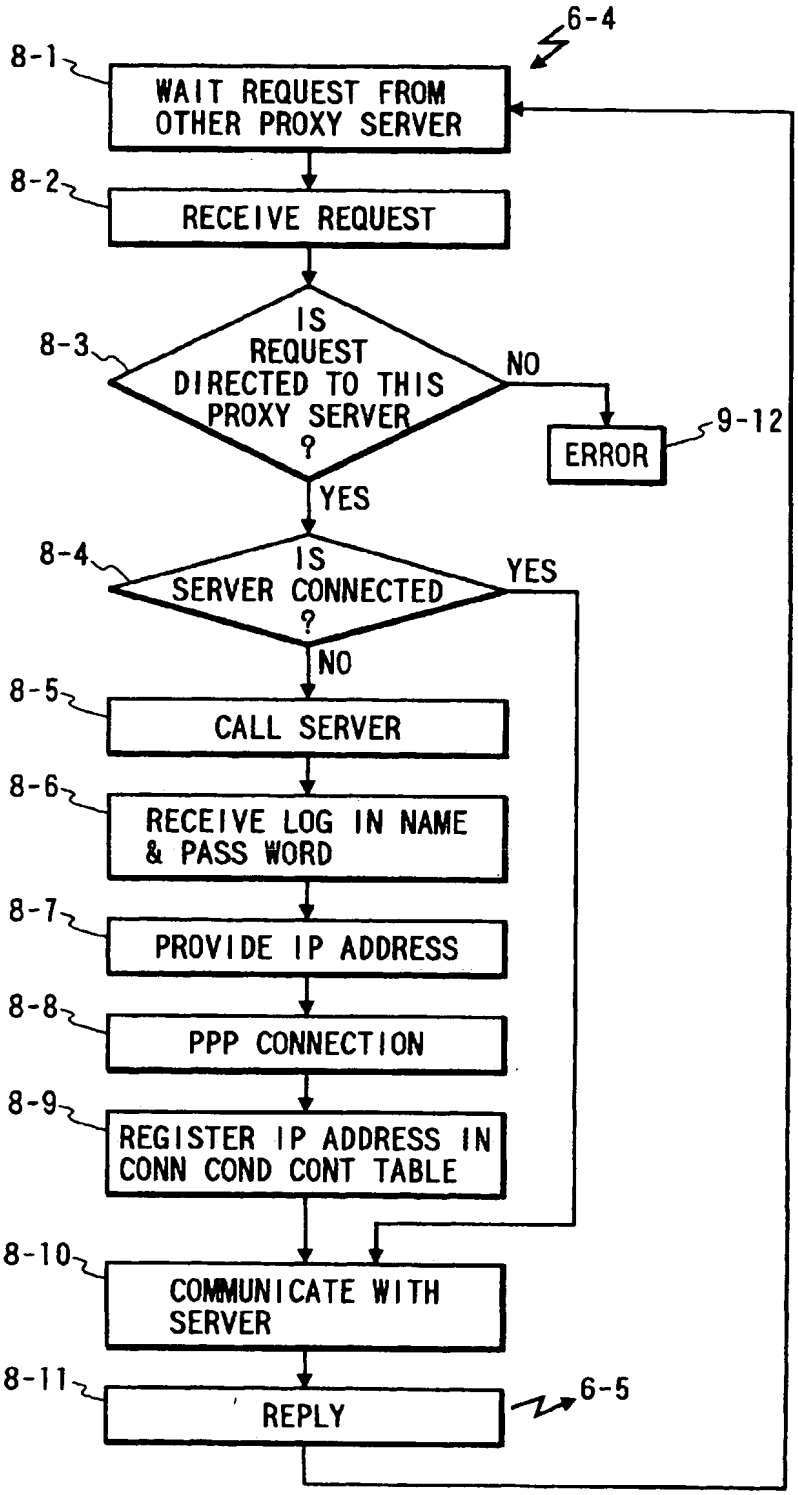
6-4
8-1
WAIT REQUEST FROM OTHER PROXY SERVER
8-2
RECEIVE REQUEST
8-3
IS REQUEST DIRECTED TO THIS PROXY SERVER ?
NO
ERROR
9-12
YES
8-4
IS SERVER CONNECTED ?
YES
NO
8-5
CALL SERVER
8-6
RECEIVE LOG IN NAME & PASS WORD
8-7
PROVIDE IP ADDRESS
8-8
PPP CONNECTION
8-9
REGISTER IP ADDRESS IN CONN COND CONT TABLE
8-10
COMMUNICATE WITH SERVER
8-11
REPLY
6-5

FIG. 9
PRIOR ART

NAME	IP ADDRESS
NANMA	133. 185. 001. 001
KAGA	133. 185. 001. 002
YAMADA	133. 185. 002. 001
SATO	133. 186. 001. 001
KATO	133. 186. 002. 001
TANAKA	133. 190. 001. 001
SUZUKI	133. 200. 001. 001

PROXY SERVER APPARATUS, A PROXY SERVER SYSTEM, AND A SERVER APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a proxy server apparatus for providing communication between a network and a server via a public telephone network connected to the server, a proxy server system including a plurality of server apparatuses, and the server coupled to the network via the proxy server and the public telephone network.

2. Description of the Prior Art

Generally, in the TCP/IP communication, when a client requests connection to a server, a connection can be provided by specifying the IP address of the server. However, due to the popularization of the Internet, the network becomes big and there are many servers, so that it becomes difficult to control all IP addresses of servers. Thus, DNS (Domain Name Services) has been developed.

A DNS server searches an IP address from the specified name of the server. Thus, when connection is made to a server without directly specifying the IP address of the server a DNS server searches the corresponding IP address from specified name of the server. FIG. 9 is a prior art table controlled by the DNS server. In the DNS, names of servers coupled to the network correspond IP addresses one to one, that is, the IP addresses have been determined in advance.

In that structure, it is necessary that the server has an IP address previously determined and is always connected to the network. If the server is provided within a public area, there is no problem in this structure. However, if a server is provided in a home, it is necessary to connect to the network through a public telephone network and if it is always connected to the network, a telephone charge is high. When a server in a home, the number of times of accessing per unit interval is not so high. Accordingly, it is desirable desired to connect the server to the network only when there is a necessity for connection to suppress the telephone charge.

Moreover, in the case that the general home use computer is connected to a network through a public telephone network, the PPP (Point to Point Protocol) is used. In the PPP connection, because the number of the IP addresses is limited, the home use computer does not have IP addresses and an IP address is dynamically assigned to a home use computer on connection and the address is used only while the computer is connected to the network.

SUMMARY OF THE INVENTION

The aim of the present invention is to provide an improved proxy server apparatus, an improved proxy server system, and an improved server apparatus.

According to the present invention, a first proxy server apparatus coupled to a network and a public telephone network is provided which comprises: a receiving portion for receiving a request from a client terminal coupled to the network, for connection to a desired server apparatus via the public telephone network, the request including a name of the server; an address table for storing the name and corresponding telephone number; a point-to-point protocol connection portion for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses used in the network to the desired server apparatus from the name in accordance with the address table and for providing point-to-point protocol connection between the

desired server apparatus and the proxy server apparatus; and a communication providing portion for providing communication between the client terminal and the desired server apparatus using the Internet protocol address.

In the first proxy server, the communication providing portion may further provide communication between any other client terminals and the desired server apparatus using the Internet protocol address in response to another request from any other client terminals while the Internet protocol address is assigned to the desired server apparatus.

In the first proxy server, the point-to-point protocol connection portion may release the Internet protocol address in response to a disconnection information from the desired server apparatus.

According to the invention, a second proxy server apparatus coupled to a network controlled with Internet protocol addresses and a public telephone network is provided which, comprises: a request receiving portion for receiving a request from a client terminal through the network for communicating with a server apparatus to be coupled to a network through the network and the public telephone network; a connection condition control table for storing a name of the server apparatus and the corresponding telephone number in the public telephone network and correspondingly storing Internet protocol addresses while the server apparatus are connected thereto; a connection condition controlling portion for checking whether the server apparatus is connected to the network in accordance with the connection condition control table; a point-to-point protocol connection portion for dynamically assigning one of the Internet protocol addresses to the server apparatus if the server apparatus is not being connected to the network by checking the connection condition controlling portion and for providing a point-to-point connection if the server apparatus is not being connected to the network; a data communication portion for providing data communication with the one of server apparatus with the dynamically assigned the one of Internet protocol address; and a request response portion for transmitting a communication result from the data communication portion as a reply in response to the communication request to the client terminal.

In the second proxy server apparatus, the connection control portion receives a disconnection request from the server apparatus and releases the Internet protocol address corresponding to the server apparatus.

According to the invention, a proxy server system including a plurality of proxy server apparatus coupled to a network controlled with Internet protocol addresses and a public telephone network is provided, each proxy server apparatus comprising: a proxy server apparatus arrangement table for representing corresponding relations between names of a plurality of server apparatus and names of a plurality of server apparatus in charge of the plurality of proxy server apparatus; a receiving portion for receiving a request, from a client terminal coupled to the network directly or via another one of the plurality of proxy server apparatus, for connection to one of the plurality of server apparatus; a forwarding portion for forwarding the request to one of the proxy server apparatus in charge of the one of the plurality of server apparatus through the network in accordance with the proxy server apparatus arrangement table when the one of the plurality of server apparatus is not in charge of this proxy server apparatus; an address table for storing the name and the corresponding telephone number of the one of the plurality of server apparatus in charge of this proxy server apparatus; a point-to-point protocol connection

portion for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses to the one of the plurality of server apparatus from the name in accordance with the address table and for providing a point-to-point protocol connection between the one of server apparatus and this proxy server apparatus, when the one of the plurality of server apparatus is in charge of this proxy server apparatus; and a communication providing portion for providing communication between the client terminal and the one of the plurality of server apparatus using the Internet protocol address.

In the proxy server system, the proxy server apparatus arrangement table is determined in accordance with distances in the public telephone network between the server apparatus and the plurality of proxy server apparatus.

In the proxy server system, the proxy server apparatus arrangement table is determined in accordance with data rates of the plurality of proxy server apparatus.

In the proxy server system, the proxy server apparatus arrangement table is determined in accordance with data rate of the plurality of proxy server apparatus and distances in the public telephone network between the server apparatus and the plurality of proxy server apparatus.

According to the invention, a third proxy server apparatus coupled to a network controlled with Internet protocol addresses and a public telephone network is provided, which comprises: a proxy server apparatus arrangement table for representing corresponding relations between names of the proxy server apparatus and other server apparatus coupled to the network and names of a plurality of server apparatus in charge of the proxy server apparatus and the other proxy server apparatus; a receiving portion for receiving a request, from a client terminal coupled to the network directly or via one of the other proxy server apparatus, for connection to one of the plurality of server apparatus; a forwarding portion for forwarding the request to one of the other proxy server apparatus in charge of the one of the plurality of server apparatus through the network in accordance with the proxy server apparatus arrangement table when the one of the plurality of server apparatus is not in charge of this proxy server apparatus; an address table for storing the name and the corresponding telephone number of the one of the plurality of server apparatus in charge of this proxy server apparatus; a point-to-point protocol connection portion for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses to the one of the plurality of server apparatus from the name in accordance with the address table and for providing a point-to-point protocol connection between the one of server apparatus and this proxy server apparatus, when the one of the plurality of server apparatus is in charge of this proxy server apparatus; and a communication providing portion for providing communication between the client terminal and the one of the plurality of server apparatus using the Internet protocol address.

In the third proxy server apparatus, the communication providing portion provides the communication between the client terminal and the one of the plurality of server apparatus via the another one of the plurality of proxy server apparatus when the request is from the client terminal via the another one of the plurality of proxy server apparatus.

According to this invention, a server apparatus coupled to a network through a point-to-point protocol connection via a public telephone network is provided, which comprises: a timer portion for measuring continuously non-communication conditions of client terminals coupled thereto; and a disconnection control portion for disconnecting the server apparatus from the public telephone network when all client terminals are in a non-communication condition for a predetermined interval.

BRIEF DESCRIPTION OF THE DRAWINGS

The object and features of the present invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. **1** is a block diagram of a proxy server apparatus and a server of a first embodiment, wherein their communication system is also shown;

FIG. **2** depicts a flow chart showing an operation of the proxy server apparatus of the first embodiment;

FIG. **3** is a communication control table, shown in FIG. 1, illustrating relations among server names, IP addresses, and telephone numbers;

FIG. **4** shows a table of the communication condition control table **42** shown in FIG. 1;

FIG. **5** is a block diagram of a proxy server system of a second embodiment;

FIG. **6** depicts a flow chart of the second embodiment showing an operation of the proxy server apparatus;

FIG. **7** shows a proxy server apparatus arrangement table shown in FIG. **5**;

FIG. **8** depicts a flow chart of the second embodiment showing an operation of the proxy server apparatus; and

FIG. **9** is a prior art table controlled by the DNS server.

The same or corresponding elements or parts are designated with like references throughout the drawings.

DETAILED DESCRIPTION OF THE INVENTION

<First Embodiment>

FIG. **1** is a block diagram of a proxy server apparatus and a server of a first embodiment, wherein their communication system are also shown.

In FIG. **1**, a client terminal **1** is coupled to a network **5**, the proxy server apparatus **2** is coupled to the network **5** and a public telephone network **3**, and a server **4** is coupled to the proxy server apparatus **2** through the public telephone network **3**.

The proxy server apparatus **2** comprises a request receiving portion **21** for receiving a request from the client terminal **1** through the network **5** for requesting a communication with the server apparatus **4**, a connection condition control portion **22** for controlling connection to and disconnection from the server apparatus, a public telephone network connection portion **23** for assigning an IP address and providing PPP connection to the server apparatus **4** through the public telephone network **3**, a data communication portion **24** for effecting a data communication with the connected server apparatus **4**, a request response portion **25** for returning a reply in response to the communication request from the client terminal **1**, a connection condition control table **200** for controlling IP addresses dynamically assigned in accordance with a name of a server apparatus and a telephone number corresponding to the name of the server apparatus.

An operation will be described.

FIG. **2** depicts a flow chart showing an operation of the proxy server apparatus **2** of the first embodiment. FIG. **3** is a communication control table, shown in FIG. **1**, illustrating relations among server names, IP addresses, and telephone numbers.

In step 2-1, the proxy server apparatus 2 waits for a communication request with the server apparatus 4 from the client terminal 1 connected to the network 5. When there is the communication request with the server apparatus having name YAMADA, the proxy server apparatus 2 receives the communication request in step 2-2. Then, the proxy server apparatus 2 checks whether the server apparatus 4 is being connected to the network 5 by checking the communication condition control table 200.

As shown in FIG. 3, each row of the connection condition control table shows a name of the server, the corresponding IP address in the network 5, and the corresponding telephone number in the public telephone network 3. In the connection condition control table 200, if there is a value at the column of the IP address, the corresponding server is being connected to the network 5 and if there is no value at the column of the IP address, the corresponding server is not connected to the network. In the case shown in FIG. 3, server apparatus NANMA and server apparatus YAMADA are connected and IP addresses 133.185.001.001 and 133.185.001.002 are assigned. On the other hand, the server apparatus YAMADA is not connected to the proxy server apparatus 2.

In step 2-3, if the server apparatus is connected to the proxy server apparatus 2, a communication with the server apparatus is made in step 2-9.

As mentioned, in this embodiment, it is assumed that the server apparatus YAMADA 4 is not connected, in step 2-4, the proxy server 2 makes a call with the telephone number 03-7890-1234 toward the public telephone network 3. When the connection is provided, the server apparatus YAMADA 4 transmits a log-in name and a password. The proxy server apparatus 2 receives the log-in name and the password in step 2-5. Then, the proxy server apparatus certifies the server from the log-in name and the password and assigns one of IP addresses to the server apparatus YAMADA 4 in step 2-6.

The proxy server apparatus 2 assigns the IP address as follows.

At first, the proxy server apparatus 2 checks one of IP address as to whether the IP address is being used. If the IP address is not used, the proxy server apparatus 2 assigns the IP address to the server apparatus 4. For example if the proxy server apparatus 2 holds ten IP addresses from 133.185.001.001 to 133.185.001.010, the IP addresses 133.185.001.003 is not used, the proxy server apparatus 2 assigns this IP address to the server apparatus 4. After assigning the IP address, in step 2-7, the proxy server apparatus 2 tries to establishing the PPP connection with the server apparatus YAMADA. When, the PPP connection has been established, the proxy server apparatus 2 registers the IP address 133.185.001.003 at the column of the IP address at the row of the server apparatus YAMADA 4 in the communication condition control table 200 in step 2-8. In the following step 2-9, the proxy server apparatus 2 effects data communication with the server apparatus YAMADA 4 and transmits a reply to the client terminal 1.

Then, a releasing operation will be described. There are two cases of releasing. That is, releasing is effected by a command from the client terminal 1 and is effected by the server apparatus 4. If the client terminal 1 and the server apparatus communicate with each other one to one and the client terminal 1 decides that there is no necessity in communication with the server apparatus 4, it is possible to disconnect the circuit in response to a command from the client terminal 1. However, if there are a plurality of client terminals communicating with the server apparatus 4, it is prevented from disconnecting the circuit from the server apparatus 4 in response to only the command from one client terminal.

Therefore, in order to control a disconnection from client terminals, the server apparatus 4 comprises a disconnection control portion 40 for controlling disconnection from clients, a timer 41 for measuring an interval of non-communication conditions in the connection conditions every client and a communication condition control table 42 for storing conditional data indicative of a communication condition or a non-communication condition and a continues non-communication interval for every registered client.

The disconnection control portion 40 of the server apparatus 4 measures non-communication intervals with respect to all clients registered in the communication condition control table 42 using the timer 41 and if all client terminals are in the non-communication condition, the circuit between the proxy server apparatus 2 and the server apparatus 4 is disconnected.

FIG. 4 shows a table of the communication condition control table 42 shown in FIG. 1. The communication condition control table 42 stores conditional data indicative of the communication condition or a non-communication condition and a continuous non-communication interval for every IP address of the registered client. The disconnection control portion 40 of the server apparatus 4 registers an IP address of a client requesting a communication with the server apparatus when the PPP connection is established. If one of the client terminals makes a communication with the server apparatus 4, the disconnection control portion 40 stores data indicative of the communication condition in the column of the communication condition at the row of the client terminal and makes the data of the continuous non-communication interval zero. On the other hand, when the communication has finished, the disconnection control portion 40 stores data indicative of the non-communication condition at the row of the client terminal. Moreover, the disconnection control portion 40 checks the communication conditions every client terminal periodically, for example, every five minutes using the timer 41. Then, the disconnection control portion 40 calculates a continuous non-communication interval for every client terminal in the non-communication condition. If the continuous non-communication interval reaches a predetermined value, for example, sixty minutes, the disconnection control portion 40 judges that the circuit between the proxy server apparatus and the server apparatus 4 is not used. If the circuit is not used, the disconnection control circuit 40 informs the connection control portion 22 of the proxy server apparatus 2 of the disconnection, disconnects the circuit, and erases all data in the disconnection control table 42.

If there is a request for erasing the data about one client terminal in the disconnection control table 42, the disconnection control portion 42 erases only the data about the client terminal in the disconnection control table 42. If there are the request for erasing the data about clients from all client terminals 1, the disconnection control portion 42 can disconnect the circuit between the proxy server apparatus 2 and the server apparatus 4 immediately.

In this embodiment, the clients are controlled with the IP addresses, so that if the same client terminal makes a communication with the server apparatus 4 again, it is unnecessary to increase the row of the disconnection control table. Therefore, the disconnection control table 42 is efficiently controlled.

When the connection condition control portion 22 is informed of the disconnection from the server apparatus 4, the connection condition control portion 22 erases the data in the column of the IP address corresponding to the client terminals.

As mentioned, the server exists beyond a public telephone network and thus, the server is not connected to a network usually through the public telephone network and the proxy server apparatus. Therefore its IP address is not always assigned. However, the client terminal can connect to the server apparatus being informed of the name of the server apparatus through the PPP connection because one of IP addresses held by the proxy server apparatus is dynamically assigned to the server apparatus.

Moreover, if there is no access to the server apparatus **4** from a plurality of client terminals for a predetermined interval, the server apparatus **4** can automatically disconnect the telephone circuit after informing the proxy server apparatus **2** of disconnection, so that a telephone charge for the server apparatus is saved.

<Second Embodiment>

FIG. **5** is a block diagram of a proxy server system of a second embodiment.

In the client server system of the second embodiment, there are a plurality of proxy server apparatuses **6** and **9** because there a lot of server apparatuses to be coupled to the network **5** through the proxy server apparatuses **6** and **9**. In this case, it is necessary to control connecting operations between the proxy server apparatuses **6** and **9**.

The basic structure and operation of the proxy server apparatuses **6** and **9** are similar to those of the first embodiment. The difference is that a plurality of the proxy server apparatus are provided, a request receiving portion **61** or **91** further receives the request for communication with the server apparatuses from other proxy server apparatuses and each proxy server apparatus further comprises a proxy server arrangement table **600** or **900**.

A server apparatus **8** is coupled to the network **5** through the public network **3** and the proxy server apparatus **6**. A server apparatus **11** is coupled to the network **5** through the public telephone network **3** and the proxy server apparatus **9**. The proxy server apparatus **6** controls the server apparatus **8** and the proxy server apparatus **9** controls the server apparatus **11**.

An operation will be described.

FIG. **6** depicts a flow chart of the second embodiment showing an operation of the proxy server apparatuses **6** or **9** when a communication request is directly transmitted from the client terminal **1**. FIG. **7** shows a proxy server apparatus arrangement table shown in FIG. **5**. FIG. **8** depicts a flow chart of the second embodiment showing an operation of the proxy server apparatuses **6** or **9** when a communication request is forwarded.

In this embodiment, it is assumed that the proxy server apparatus **6** is named as TOKYOSV, the proxy server apparatus **9** is named as CHIBASV, and the server apparatus **11** is named as SUZUKI.

In step **6-1**, the proxy server apparatus **6** waits for a communication request for communicating with the server apparatus **8** from the client terminal **1** connected to the network **5**. When there is the communication request with the server apparatus **11** having name SUZUKI, the proxy server apparatus **6** receives the communication request in step **6-2**. Then, the proxy server apparatus **6** checks whether the server apparatus SUZUKI **11** is controlled by the proxy server apparatus **6** itself from the proxy server arrangement table **600**. If the server apparatus SUZUKI **11** is controlled by the proxy server apparatus **6** itself, processing proceeds to step **2-3** in FIG. **2** to provide the PPP connection as similar to the first embodiment.

In this embodiment, as shown in FIG. **7**, the server apparatus SUZUKI **11** is controlled by the proxy apparatus **6**. Therefore, processing proceeds to step **6-4**. Then, the proxy server apparatus **6** communicates with the proxy server apparatus **9** through the network **5**.

The proxy server apparatus **9** receives the request for communication with the server apparatus SUZUKI **11** forwarded by the proxy server apparatus **6** in step **8-2** and makes a decision whether the server apparatus SUZUKI **11** is controlled by the proxy server apparatus **9** itself from the proxy server arrangement table **900**. If the server apparatus SUZUKI 11 is controlled by the proxy server apparatus **9** itself, processing proceeds to step **8-4**. From step **8-4** to **8-10** or steps **8-4** and **8-10** are executed as similar to steps **2-3** to **2-9** or step **2-3** and **2-9** in the first embodiment.

In step **8-11** following to step **8-10**, the proxy server apparatus **9** transmits a replay to the proxy server apparatus **6** including IP address assigned to the server apparatus **11**. In response to this, the proxy server apparatus **6** receives this replay from the proxy server apparatus **11** including assigned IP address and forwards the IP address to the client terminal **1** in step **6-6**. Then, the client terminal **1** can communicate with the server apparatus **11** through the proxy server apparatus **9** via the proxy server apparatus **6** and the public telephone network **3** with the IP address assigned by the proxy server apparatus **9**. The IP address of the proxy server apparatus **9** is also transmitted.

According to this structure, a communication service between the client terminal **1** and the server **11** can be adaptively provided. For example, if the server apparatus **11** and the proxy server **9** are located in CHIBA prefecture and the proxy server apparatus **6** is located in TOKYO which is slightly distant from CHIBA prefecture, it is good for the client terminal 1 (in CHIBA) to communicate with the server apparatus **11** through the proxy server **9** (in CHIBA) rather than the proxy server apparatus **6** (in TOKYO) because a distance in the public network **3** is shorter and thus, the telephone charge is cheaper. That is, in this system, the proxy server apparatus arrangement table **600** or **900** is determined in accordance with distances D1 and D2 in the public telephone network **3** between the server apparatus and the proxy server apparatus **6** or **9**. However, if telephone charge is fixed irrespective of a distance, in consideration of data rate of the proxy server apparatus DATA RATE A or DATA RATE B, the proxy server apparatus arrangement table is determined in accordance with a data rate. Generally, the telephone charge increases with the distance in the public network **3**, so that the distance is also important parameter. Then, the proxy server apparatus arrangement table is determined in accordance with the data rates and distances in the public telephone network between the server apparatus and the plurality of proxy server apparatus.

What is claimed is:

1. A proxy server apparatus coupled to a network and a public telephone network, said proxy server apparatus comprising:

receiving means for receiving a request from a client terminal coupled to said network, for connection to a desired server apparatus via said public telephone network, said request including a name of said server;

an address table for storing a name and corresponding telephone number;

point-to-point protocol connection means for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses used in said network to said desired server apparatus from said name in accordance with said address table and releasing said Internet protocol address in response to disconnection request information from said desired server apparatus

and for providing point-to-point protocol connection between said desired server apparatus and said proxy server apparatus; and

communication providing means for providing communication between said client terminal and said desired server apparatus using said Internet protocol address.

2. A proxy server apparatus coupled to a network controlled with Internet protocol addresses and a public telephone network, said proxy server apparatus comprising:

request receiving means for receiving a request from a client terminal through said network for communicating with a server apparatus to be coupled to a second network through said network and said public telephone network;

a connection condition control table for storing a name of said server apparatus and the corresponding telephone number in said public telephone network and correspondingly storing Internet protocol addresses while said server apparatus is connected thereto;

connection condition controlling means for checking whether a server apparatus is connected to said network in accordance with said connection condition control table and for receiving a disconnection request from said server apparatus and releasing said Internet protocol addresses corresponding to said server apparatus;

point-to-point protocol connection means for dynamically assigning one of said Internet protocol addresses to said server apparatus if said server apparatus is not being connected to said network by checking said connection condition controlling means and for providing a point-to-point connection if said server apparatus is not being connected to said network;

data communication means for providing data communication with said server apparatus with the dynamically assigned said one of Internet protocol addresses; and

request response means for transmitting a communication result from said data communication means as a reply in response to said communication request to said client terminal.

3. A proxy server system including a plurality of proxy server apparatuses coupled to a network controlled with Internet protocol addresses and a public telephone network, each proxy server apparatus comprising:

a proxy server apparatus arrangement table for representing corresponding relations between names of a plurality of server apparatuses and names of a plurality of server apparatuses in charge of said plurality of proxy server apparatuses;

receiving means for receiving a request from a client terminal coupled to said network directly or via one of said plurality of proxy server apparatuses for connection to one of said plurality of server apparatuses;

forwarding means for forwarding a request to one of said proxy server apparatuses in charge of one of said plurality of server apparatuses through said network in accordance with said proxy server apparatus arrangement table when said one of said plurality of server apparatuses is not in charge of a requested proxy server apparatus;

an address table for storing the name and corresponding telephone number of one of said plurality of server apparatuses in charge of a requested proxy server apparatus;

point-to-point protocol connection means for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses to one of said plurality of server apparatuses from a name in accordance with said address table and for providing a point-to-point protocol connection between one of said server apparatuses and a requested proxy server apparatus, when said one of said plurality of server apparatuses is in charge of a requested proxy server apparatus; and

communication providing means for providing communication between said client terminal and said one of said plurality of server apparatuses using said Internet protocol address.

4. A proxy server system as claimed in claim 3, wherein said proxy server apparatus arrangement table is determined in accordance with distances in said public telephone network between said server apparatus and said plurality of proxy server apparatuses.

5. A proxy server system as claimed in claim 3, wherein said proxy server apparatus arrangement table is determined in accordance with data rates of said plurality of proxy server apparatuses.

6. A proxy server system as claimed in claim 3, wherein said proxy server apparatus arrangement table is determined in accordance with data rates of said plurality of proxy server apparatuses and distances in said public telephone network between said server apparatus and said plurality of proxy server apparatuses.

7. A proxy server apparatus coupled to a network controlled with Internet protocol addresses and a public telephone network, comprising:

a proxy server apparatus arrangement table for representing corresponding relations between names of said proxy server apparatuses and other proxy server apparatuses coupled to said network and names of a plurality of server apparatuses in charge of said proxy server apparatuses and said other proxy server apparatuses;

receiving means for receiving a request from a client terminal coupled to said network directly or via one of said other proxy server apparatuses, for connection to one of said plurality of server apparatuses;

forwarding means for forwarding a request to one of said other proxy server apparatuses in charge of one of said plurality of server apparatuses through said network in accordance with said proxy server apparatus arrangement table when said one of said plurality of server apparatuses is not in charge of said proxy server apparatus;

an address table for storing the name and corresponding telephone number of one of said plurality of server apparatuses in charge of a proxy server apparatus;

point-to-point protocol connection means for dynamically assigning an Internet protocol address from predetermined Internet protocol addresses to one of said plurality of server apparatuses from a name in accordance with said address table and for providing a point-to-point protocol connection between one of said server apparatuses and a proxy server apparatus, when said one of said plurality of server apparatuses is in charge of a proxy server apparatus; and

communication providing means for providing communication between said client terminal and said one of

said plurality of server apparatuses using said Internet protocol address.

8. A proxy server system as claimed in claim 7, wherein said communication providing means provides said communication between said client terminal and said one of said plurality of server apparatuses via said another one of said plurality of proxy server apparatuses when said request is from said client terminal via said another one of said plurality of proxy server apparatuses.

9. A proxy server system as claimed in claim 3, wherein said forwarding means is substantially directly connected to said proxy server apparatus arrangement table.

10. A proxy server apparatus as claimed in claim 7, wherein said forwarding means is substantially directly connected to said proxy server apparatus arrangement table.

* * * * *

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United States Patent [19]

Elledge

[11] Patent Number: 6,044,399

[45] Date of Patent: Mar. 28, 2000

[54] **INFERRING THE IDENTITY OF A PREFERRED SERVER FROM CONFIGURATION INFORMATION**

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[73] Assignee: **Micron Electronics, Inc.**, Nampa, Id.

[21] Appl. No.: **09/032,170**

[22] Filed: **Feb. 27, 1998**

[51] **Int. Cl.**[7] **G06F 13/00**

[52] **U.S. Cl.** **709/220**

[58] **Field of Search** 709/200, 201, 709/203, 217, 218, 219, 220, 221, 223, 224, 225, 226, 229, 236, 238

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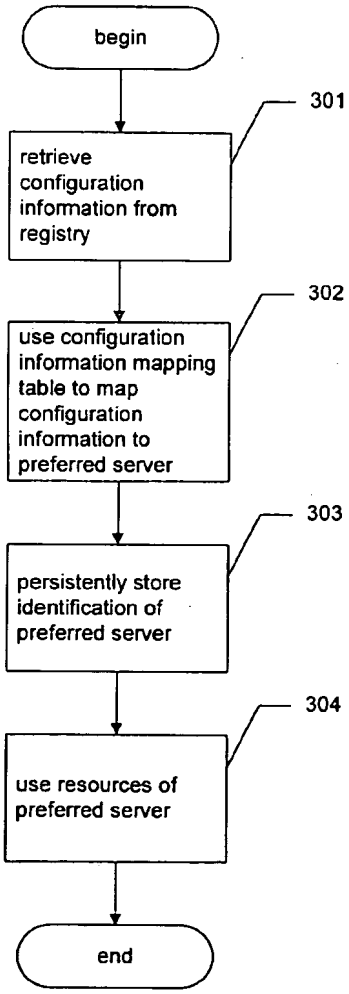
Primary Examiner—Moustafa M. Meky

Attorney, Agent, or Firm—Dorsey & Whitney LLP

[57] **ABSTRACT**

An embodiment of the present invention provides a software facility for inferring the identity of a preferred server for use by a computer system. The facility first reads system configuration information describing the configuration of the computer system. The facility also reads configuration mapping information specifying a mapping from system configuration information to preferred servers. The facility then applies the read mapping information to the read system configuration information to identify a preferred server for the computer system. In some embodiments, the computer system proceeds to consume resources of the preferred server identified in this manner.

20 Claims, 5 Drawing Sheets



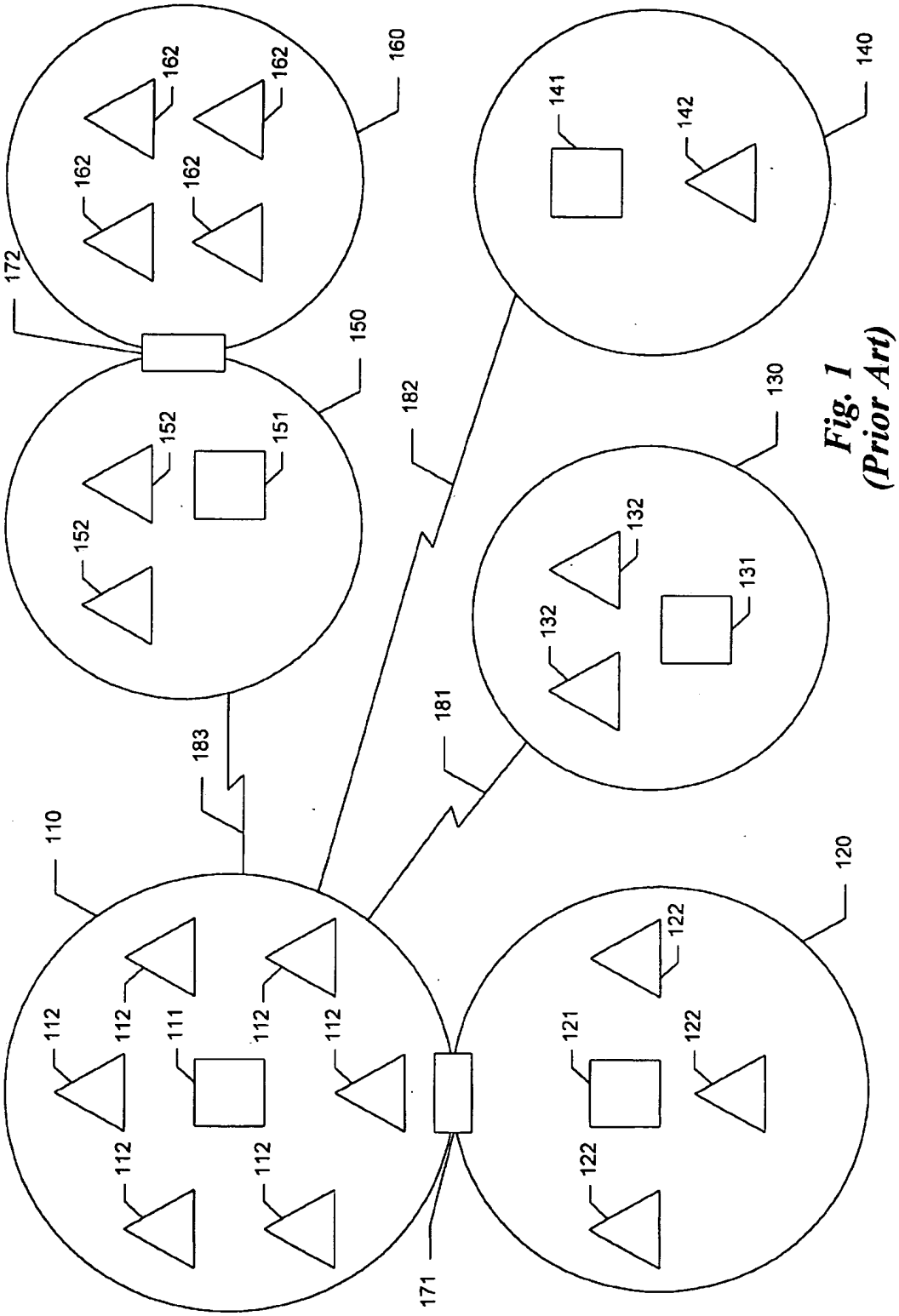


Fig. 1
(Prior Art)

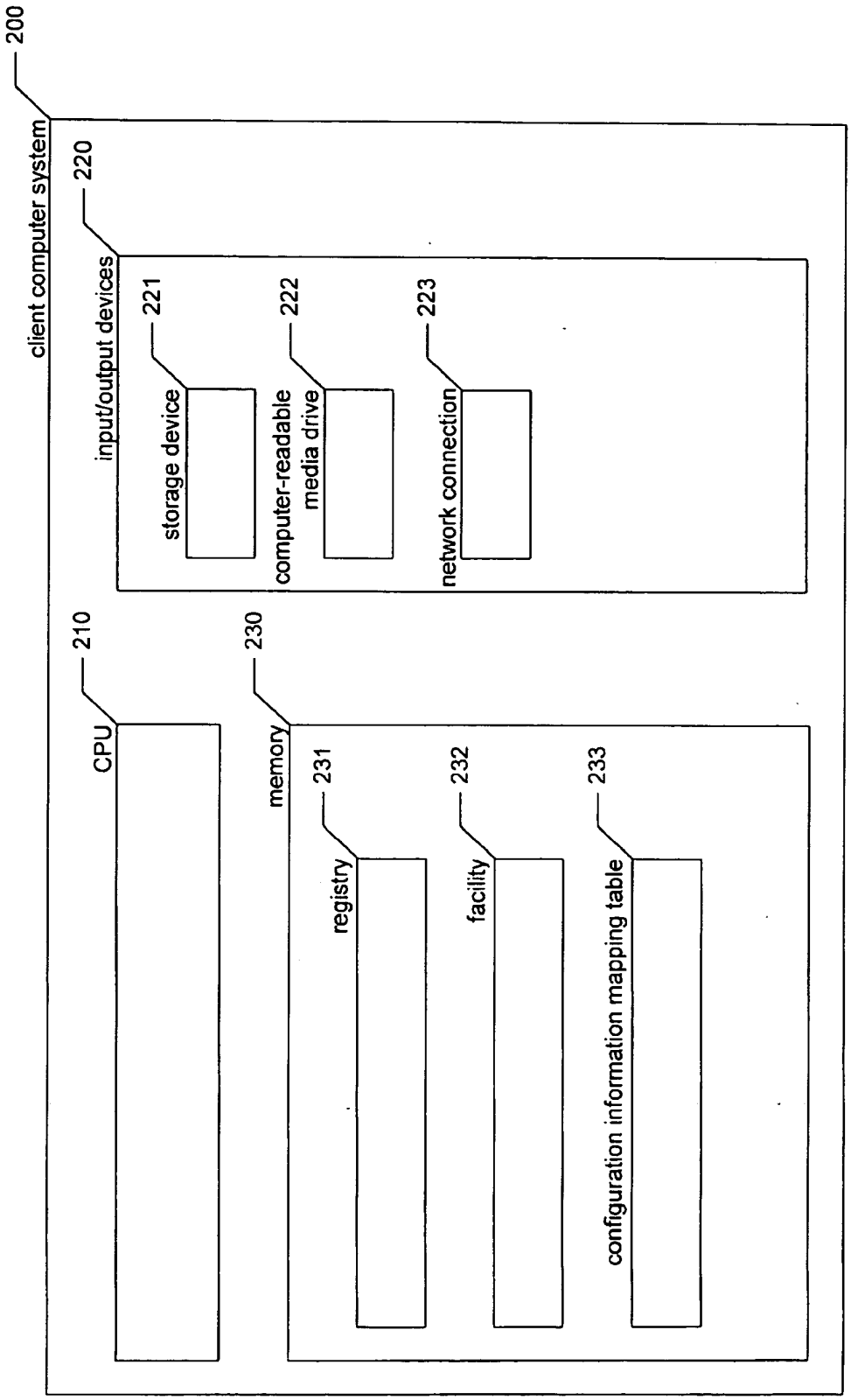

200
client computer system
220
input/output devices
221
storage device
222
computer-readable media drive
223
network connection
210
CPU
230
memory
231
registry
232
facility
233
configuration information mapping table

Fig. 2

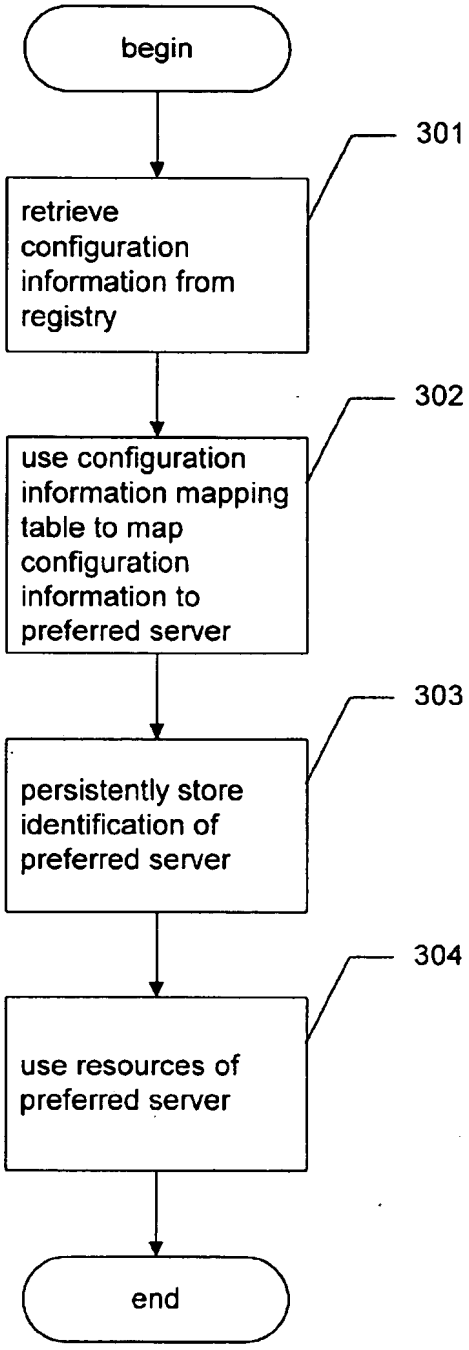

begin
301
retrieve configuration information from registry
302
use configuration information mapping table to map configuration information to preferred server
303
persistently store identification of preferred server
304
use resources of preferred server
end

Fig. 3

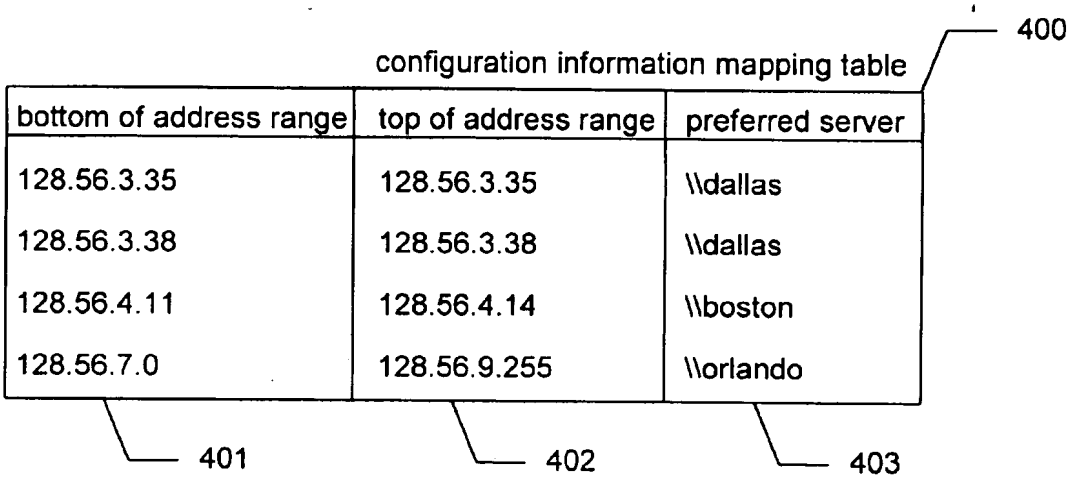

400
configuration information mapping table
bottom of address range
top of address range
preferred server
128.56.3.35
128.56.3.35
\\dallas
128.56.3.38
128.56.3.38
\\dallas
128.56.4.11
128.56.4.14
\\boston
128.56.7.0
128.56.9.255
\\orlando
401
402
403

Fig. 4

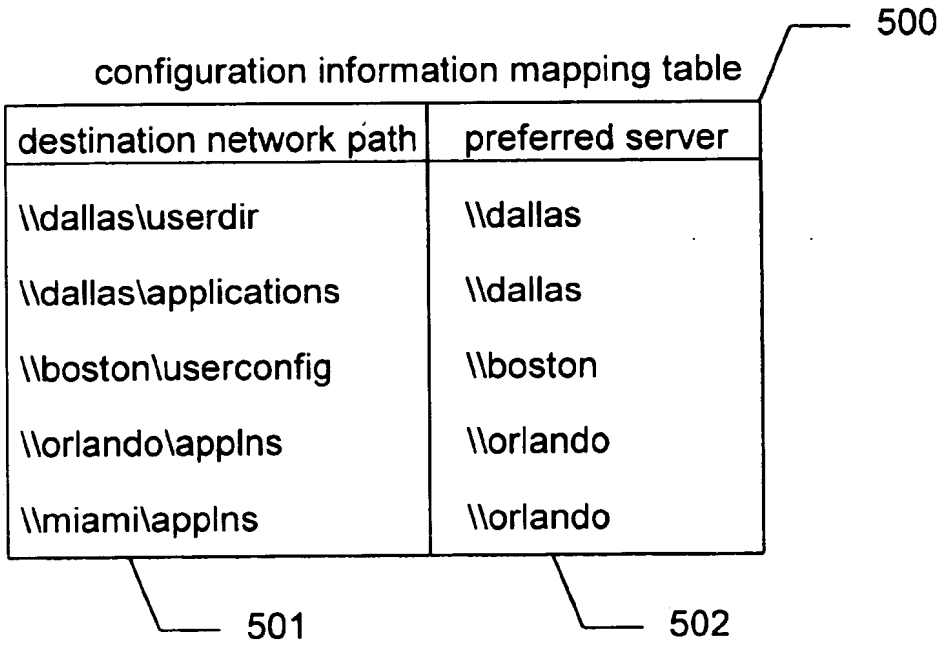
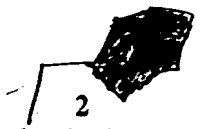

500
configuration information mapping table
destination network path
preferred server
\\dallas\userdir
\\dallas
\\dallas\applications
\\dallas
\\boston\userconfig
\\boston
\\orlando\applns
\\orlando
\\miami\applns
\\orlando
501
502

Fig. 5



INFERRING THE IDENTITY OF A PREFERRED SERVER FROM CONFIGURATION INFORMATION

TECHNICAL FIELD

The present invention relates to the fields of network resource utilization and computer system configuration.

BACKGROUND OF THE INVENTION

Many companies and other geographically distributed organizations operate wide area networks. Such networks typically use long-distance links to connect a number of geographically separate local area networks, which in turn each connect a group of geographically clustered computer systems, such as those in the same building or on the same campus.

FIG. 1 is a network diagram depicting a typical wide area network. It shows that the wide area network comprises six different local area networks **110**, **120**, **130**, **140**, **150**, and **160**. Pairs of these local area networks are connected in the wide area network by long-distance links: local area networks **110** and **130** are connected by link **181**, local area networks **110** and **140** are connected by link **182**, and local area networks **110** and **150** are connected by link **183**. Such links may be operated by the organization, or be operated by another company to transmit data on the organization's behalf. Because local area networks **110** and **120** geographically proximal, their connection does not require a long-distance link. They are instead connected by a gateway **171**. Local area networks **150** and **160** are also geographically proximal, and are connected by gateway **172**.

Many of the local area networks contain server computer systems ("servers"), shown as squares. For example, local area network **110** contains server **111**. The servers preferably provide resources, such as the capacity to execute application programs or download application programs and data, to client computer systems ("clients"), shown as triangles (e.g., clients **112** in local area network **110**). Utilization by a client of a server's resources generally requires communication between the client and the server. For example, use by a client of a server's capacity to download an application program generally requires the client to transmit a request for the application program to the server, and the server to transmit a reply to the client containing the data comprising the requested application program.

For a particular client, this communication required to use resources of a server has varying financial, performance, and/or congestion costs depending on which server is selected. As a result, selection of a server by a client can have significant consequences. For example, consider one of the clients **112** in local area network **110**. For this client, using resources on server **111**, which is also in local area network **110**, has low performance, financial, and congestion costs: because local area networks are relatively fast, the necessary data is communicated quickly; because the organization owns the local area network, no financial marginal cost is incurred in such communication; and because the local area network **110** has ample capacity, no congestion cost is incurred. In contrast, using servers **121**, **131**, **141**, and **151** has greater performance, financial, and congestion costs. Use by one of the clients **112** of server **131** in local area network **130** may incur significant financial cost if link **181** is not owned by the organization and the organization is charged to transmit data across link **181**. Use by one of the clients **112** of server **141** in local area network **140** may incur significant performance cost if local area network **140** is geographically distant from local area network **110**, causing a long propagation delay for transmitting data across link **182**. A significant performance cost may also be incurred in using server **151** in local area network **150** if link **183** has a low data transmission rate, causing a low throughput rate for the transmitted data. Finally, while using server **121** in local area network **120** may have not have direct financial or performance costs, it may create congestion in gateway **171**, indirectly imposing performance costs on other users if use of the gateway by one of the clients **112** delays use of the gateway by other clients **112** or by clients **122**. It can therefore be seen that, because of higher financial, performance, and/or congestion costs incurred by using servers **121**, **131**, **141**, and **151**, use of server **111** by one of the clients **112** would generally be preferred.

Unfortunately, in some wide area networks, the best available server on which to use resources is not explicitly identified to each client. As a result, clients may choose to use the resources of a distant server, in many cases incurring a significant financial, time, or congestion cost. In some cases, clients may fail to identify any available server whose resources they can use, rendering such clients unable to utilize the resources at any cost.

In view of these shortcomings, a facility capable of inferring the identity of a preferred server for each of the clients would have significant utility.

SUMMARY OF THE INVENTION

Embodiments of the present invention infer, for a client computer system, the identity of a preferred server for providing services to the client computer system. By using the invention, the client computer system can ensure that it obtains services from the best available server. In this way, the client computer system can avoid the larger financial, performance, and congestion costs of using other servers, as well as the problem of not knowing the identity of any server from which to obtain services.

Embodiments of the present invention provide a software facility ("the facility") for identifying a preferred server. The facility preferably executes on a client computer system ("client") that uses the services of one of a number of servers. The facility identifies a preferred server for use by the client using configuration information relating to the client. The configuration information may include a network address, such as an Internet Protocol address ("IP address"), identifying the client within its network, or "drive mappings" defined in the client that map disk drive identifiers (e.g., "G:") to remote file system directories located on other computer systems that are available via the network. The facility first retrieves this configuration information. In clients running the MICROSOFT WINDOWS 95 or MICROSOFT WINDOWS NT operating systems, the configuration information may be retrieved from a central repository for configuration information called the Registry. Those skilled in the art will appreciate that similar configuration information is generally available from various sources in clients running other operating systems as well.

After retrieving the configuration information, the facility uses a configuration information mapping table to determine the identity of the preferred server for the client based on the configuration information. The preferred server identified by the facility may then be used by the client to provide server services to the client. The identity of the preferred server may also be persistently stored, so that the client may use the preferred server at a future time without having to repeat the process of identifying the preferred server. On the other

hand, even if the identity of the preferred server is persistently stored, the process of identifying the preferred server may be repeated periodically in order to update the identity of the preferred server in the event that a more suitable server becomes available.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a network diagram depicting a typical wide area network.

FIG. 2 is a high-level block diagram of an example general-purpose client computer system upon which the facility may execute.

FIG. 3 is a flow diagram showing the steps preferably performed by the facility in order to infer the identity of a preferred server for use by the present server.

FIG. 4 is a data structure diagram showing a configuration information mapping table for identifying a preferred server using the numerical network address of the client.

FIG. 5 is a data structure diagram showing a configuration information mapping table for identifying a preferred server using a destination network path from the client's network drive mappings.

DETAILED DESCRIPTION OF THE INVENTION

Embodiments of the present invention infer, for a client computer system, the identity of a preferred server for providing services to the client computer system. By using the invention, the client computer system can ensure that it obtains services from the best available server. In this way, the client computer system can avoid the larger financial, performance, and congestion costs of using other servers, as well as the problem of not knowing the identity of any server from which to obtain services.

Embodiments of the present invention provide a software facility ("the facility") for identifying a preferred server. The facility preferably executes on a client computer system ("client") that uses the services of one of a number of servers. The facility identifies a preferred server for use by the client using configuration information relating to the client. The configuration information may include a network address, such as an Internet Protocol address ("IP address"), identifying the client within its network, or "drive mappings" defined in the client that map disk drive identifiers (e.g., "G:") to remote file system directories located on other computer systems that are available via the network. The facility first retrieves this configuration information. In clients running the MICROSOFT WINDOWS 95 or MICROSOFT WINDOWS NT operating systems, the configuration information may be retrieved from a central repository for configuration information called the Registry. Those skilled in the art will appreciate that similar configuration information is generally available from various sources in clients running other operating systems as well.

After retrieving the configuration information, the facility uses a configuration information mapping table, such as those shown in FIGS. 4 and 5, to determine the identity of the preferred server for the client based on the configuration information. The configuration information mapping table is preferably compiled manually, but may also be compiled automatically. Configuration information mapping tables that can be used by the facility include both tables that map from network address ranges to preferred servers and tables that map from the contents of network drive mappings to preferred servers.

The preferred server identified by the facility may then be used by the client to provide server services to the client. The identity of the preferred server may also be persistently stored, so that the client may use the preferred server at a future time without having to repeat the process of identifying the preferred server. On the other hand, even if the identity of the preferred server is persistently stored, the process of identifying the preferred server may be repeated periodically in order to update the identity of the preferred server in the event that a more suitable server becomes available.

FIG. 2 is a high-level block diagram of an example general-purpose client computer system upon which the facility may execute. The client computer system **200** contains a central processing unit (CPU) **210**, input/output devices **220**, and a computer memory (memory) **230**. Among the input/output devices is a storage device **221**, such as a hard disk drive, and a computer-readable media drive **222**, which can be used to install software products, including the facility, which are provided on a computer-readable medium, such as a CD-ROM. The input/output devices also include a network connection **223**, through which the computer system **200** may communicate with other connected computer systems, such as those shown in FIG. **1**. The memory **230** preferably contains a system registry **231** for containing configuration information relating to the client computer system **200**, as well as the facility **132** for inferring of a preferred server for use by the client computer system **200**. The memory **230** preferably also contains a configuration information mapping table **233** used by the facility to identify a preferred server based upon configuration information. The contents of the memory **230** are preferably stored persistently on the storage device **221**, and loaded into the memory when needed. While the facility is preferably implemented on one or more client computer systems configured as described above, those skilled in the art will recognize that it may also be implemented on computer systems having different configurations.

FIG. 3 is a flow diagram showing the steps preferably performed by the facility in order to infer the identity of a preferred server for use by the present server. At a high level, these steps retrieve configuration information about the computer system from the registry, and use a configuration information mapping table to identify a preferred server based on the retrieved configuration information. The identity of the preferred server is then stored, and used to use resources of the preferred server. In step **301**, the facility retrieves configuration information relating to the configuration of the computer system upon which the facility is executing from the registry. The performance of step **301** is discussed in greater detail below in conjunction with FIGS. **4** and **5**. In step **302**, the facility uses the configuration information mapping table **233** to map the configuration information retrieved in step **301** to the identity of a preferred server for the computer system **200**. In step **303**, the facility persistently stores an identification of the preferred server determined in step **302** for future use. In step **304**, the facility uses resources of the preferred server. For example, the facility may retrieve programs or data from the preferred server, may use a fax gateway in the preferred server, etc. After step **304**, these steps conclude.

As discussed above, the facility may use different kinds of configuration information in order to identify a preferred server for the client. As two examples, the facility may use a numerical network address of the client, or network paths to which disk drive identifiers have been mapped on the client. A discussion of the use of these two types of configuration information by the facility follows.

In one embodiment, the facility identifies a preferred server for the client using a network address that identifies the client within its network. In particular, the facility uses an Internet Protocol address for the client. Internet Protocol addresses each comprise a series of four component values, each between 0 and 255, separated by periods. For clients running the MICROSOFT WINDOWS 95 or MICROSOFT WINDOWS NT operating systems, the Internet Protocol address of the client may be retrieved from the registry using the RegQueryValue API of these operating systems. The RegQueryValue API takes as parameters a "key" and a "value," which together identify particular configuration values within the registry to be retrieved.

In MICROSOFT WINDOWS 95, the Internet Protocol address may be retrieved from the "IPAddress" value of one of the registry keys

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\Class\
  NetTrans\000<digit>
```

where "<digit>" is replaced with the digits 0–9.

In MICROSOFT WINDOWS NT, the process of retrieving the Internet Protocol address of the client is somewhat more involved. The facility first retrieves the identifier of the network card ("<ncard>") from the "Bind" value of the

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\NetBT\Linkage
```

key. The facility then retrieves the Internet Protocol address of the client from the "IPAddress" value of the

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\<ncard>\
  Parameters\Tcpip
```

key if the "EnableDHCP" value of the

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\<ncard>\
  Parameters\\Tcpip
```

key is zero, or from the "DhcpIPAddress" value of the

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\<ncard>\
  Parameters\Tcpip
```

key if the "EnableDHCP" value of the

```
HKEY_LOCAL_
  MACHINE\System\CurrentControlSet\Services\<ncard>\
  Parameters\Tcpip
```

is one.

FIG. 4 is a data structure diagram showing a configuration information mapping table for identifying a preferred server using the numerical network address of the client. While the configuration information mapping tables used by the facility are preferably generated manually by a network administrator, they may also be generated automatically. It can be seen that the configuration information mapping table **400** contains four rows, each corresponding to a different range of network addresses. While the number of rows in the table **400** and in table **500** discussed below is limited to simplify this example, it will be appreciated by those skilled in the art that an actual configuration information mapping table may contain hundreds, or even thousands, of rows each corresponding to a different network address range. Each row in the table **400** contains information in each of three columns: a bottom of address range column **401** containing the smallest network address for the range; a top of address range column **402** containing the largest network address of the address range; and a preferred server **403** containing an identification of the preferred server for clients whose network address falls within the range. One or more rows may be included for each preferred server. For example, the first and second rows both map address ranges to a "\\dallas" server, while only the third row maps a range to the "\\boston" server, and only the fourth row maps a range to the "\\orlando" server. A range may include one network address, or a number of network addresses. For example, the range specified by the first row contains only the network address

```
128.56.3.35
```

On the other hand, the third row specifies a range containing four network addresses:

```
128.56.4.11
128.56.4.12
128.56.4.13
128.56.4.14
```

Ranges specified by the table may further specify ranges of addresses that span two or more components of the network address. For example, the range specified by the fourth row in the table **400** spans the third and fourth components of the network address:

```
128.56.7.0
128.56.7.1
...
128.56.7.255
128.56.8.0
128.56.8.1
...
128.56.8.255
128.56.9.0
128.56.7.1
128.56.9.255
```

In one embodiment, the table also specifies a default preferred server (not shown) for clients whose addresses do not fall in any of the ranges specified by the table, or whose network address is not known.

In another embodiment, the facility uses network drive mappings on the client to identify a preferred server for the client. For example, if a user of the client frequently retrieves information via the network from the remote file system directory "\\dallas\userdir", the user may map a drive

identifier such as "G:" to this remote directory in order to make retrievals from that directory more convenient. Similarly, programs executing on the client may create such mappings in order to access information on other computer systems, such as servers. It is the inventor's observation that certain of such mappings reflect the identity of a preferred server. This is especially true where client software that is uniform across all of the clients regularly maps certain drive identifiers to directories on the preferred server for the client. The destination network paths to which drive identifiers have been mapped on a client may be retrieved by enumerating the keys, each corresponding to a different mapped drive identifier, under the key

HKEY_CURRENT_USER\Network\Persistent\

and retrieving the data for the "RemotePath" of each such key. Alternatively, this value may be retrieved only for the key corresponding to a particular drive identifier, such as "G:".

FIG. 5 is a data structure diagram showing a configuration information mapping table for identifying a preferred server using a destination network path from the client's network drive mappings. It can be seen that each of the five rows of the table 500 contains information in a destination network path column 501 and a preferred server 502. As an example, if the client computer system had a network drive mapping from the drive identifier "G:" to the network path "\\dallas\userdir", then the configuration information mapping table would identify "\\dallas" as the preferred server. It can be seen that different destination network paths on the same server, such as those shown in the first and second rows of the table, may map to the same preferred server. It can further be seen that two network paths on different servers, such as those identified in the fourth and fifth rows of the table, may map to the same preferred server. In one embodiment, the table also specifies a default preferred server (not shown) for clients not having a drive identifier mapped to any of the destination network paths specified by the table.

While this invention has been shown and described with reference to preferred embodiments, it will be understood by those skilled in the art that various changes or modifications in form and detail may be made without departing from the scope of the invention. For example, other types of configuration information may be used by the facility to identify a preferred server for the client. Also, identifications of preferred servers generated by the facility may further identify specific resources, such as file system directories, of the preferred servers. Further, for a single client, the facility may identify more than one preferred server, such that the client may use some services of one preferred server and other services of another preferred server. Additionally, the facility may execute on a computer system other than the client for which a preferred server is identified, such as on a server.

I claim:

1. A method in a computer system for identifying a preferred server for use by the computer system, the computer system having a numerical network address, the method comprising the steps of:

determining the network address of the computer system;

retrieving a table indicating, for each of a plurality of ranges of numerical network addresses, a preferred server for computer systems having network addresses within the range;

comparing the determined network address of the computer system to the ranges of the table to identify a preferred server for the computer system; and

retrieving data from the identified preferred server.

2. The method of claim 1 wherein the computer system has a registry for storing configuration information relating to the computer system, and wherein the determining step reads the network address of the computer system from the registry.

3. The method of claim 1 wherein the network address of the computer system is an Internet Protocol address.

4. A method in a computer system for identifying a preferred server for use by the computer system, the computer system having one or more drive mappings from drive designations to network paths, the method comprising the steps of:

retrieving the drive mappings of the computer system;

retrieving a table comprised of entries, each entry having a source network path and a target preferred server that is preferred for computer systems having drive mappings that map a drive designation to the source network path;

if one of the drive mappings maps a drive designation to a source network path contained in the table, selecting the target preferred server for that source network path;

if none of the drive mappings maps a drive designation to a source network path contained in the table, selecting a default server;

receiving a request satisfiable using server resources; and

satisfying the request using the selected server.

5. A method in a computer system having a configuration for identifying a preferred server for use by the computer system, the method comprising the steps of:

reading system configuration information describing the configuration of the computer system;

reading configuration mapping information specifying a mapping from system configuration information to preferred servers; and

applying the read mapping information to the read system configuration information to identify a preferred server for the computer system.

6. The method of claim 5 wherein the computer system has a registry data structure containing system configuration information, and wherein the step of reading system configuration information reads system configuration information from the registry.

7. The method of claim 5 wherein the computer system has a network address, and wherein the step of reading system configuration information reads the network address of the computer system.

8. The method of claim 5 wherein the computer system has an Internet Protocol address, and wherein the step of reading system configuration information reads the Internet Protocol address of the computer system.

9. The method of claim 5 wherein the computer system has one or more drive mappings from drive designations to network paths, and wherein the step of reading system configuration information reads these mappings from drive designation to network paths.

10. The method of claim 5, further comprising the step consuming resources of the preferred server based on the identification of the preferred server.

11. The method of claim 10 wherein the consuming step retrieves an application program from the preferred server.

12. The method of claim 5, further comprising the step of persistently storing an identification of the preferred server for future use in consuming resources of the preferred server.

13. A computer-readable medium whose contents cause a computer system having a configuration to identify a preferred server for use by the computer system by performing the steps of:

reading system configuration information describing the configuration of the computer system;

reading configuration mapping information specifying a mapping from system configuration information to preferred servers; and

applying the read mapping information to the read system configuration information to identify a preferred server for the computer system.

14. The computer-readable medium of claim **13** wherein the computer system has a network address, and wherein the step of reading system configuration information reads the network address of the computer system.

15. The computer-readable medium of claim **13** wherein the computer system has one or more drive mappings from drive designations to network paths, and wherein the step of reading system configuration information reads these mappings from drive designation to network paths.

16. The computer-readable medium of claim **13** wherein the contents of the computer-readable medium further cause the computer system to perform the step consuming resources of the preferred server based on the identification of the preferred server.

17. A computer memory containing a preferred server mapping data structure for use in identifying, for a particular client computer system, a preferred server to use, the data structure comprising a plurality of entries, each entry containing an identification of one or more computer system configuration information values and an identification of a preferred server for client computer systems having one of the identified computer system configuration information values, such that, for a selected client computer system having a selected configuration information value, the data structure may be used to identify a preferred server for the selected client computer system to use by selecting an entry identifying the selected configuration information value, and by determining the server identified by the selected entry.

18. The computer memory of claim **17** wherein the configuration information values stored in the data structure are Internet Protocol addresses.

19. The computer memory of claim **17** wherein the configuration information values stored in the data structure are drive mappings, each mapping a drive designation to a network path.

20. A computer system for identifying a preferred server for use by the computer system, the computer system having a configuration, comprising:

a memory containing:

a configuration data structure containing configuration values reflecting the configuration of the computer system, and

a configuration mapping data structure containing mappings from possible configuration values to preferred servers for computer systems having such possible configuration values; and

a processor for identifying a preferred server for use by the computer system by reading a configuration value from the configuration data structure and identifying a preferred server mapped to from the read configuration value in the configuration mapping data structure.

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